Medicine Lodge Subbasin Assessment and TMDLs

February 18, 2003

3.0. Subbasin Assessment – Pollutant Source Inventory

The Medicine Lodge Subbasin has no known point sources of pollution, therefore, there are no National Pollution Discharge Elimination System (NPDES) permits within its boundaries. Major nonpoint pollution sources in this subbasin consist of land disturbance from grazing, unmaintained roads, farming, and recreation. The following provides an overview of nonpoint sources by watershed for streams currently listed as water quality limited (1998 303(d) list). There are currently five water bodies listed on the 1998 303(d) list.

3.1 Sources of Pollutants of Concern

The Medicine Lodge subbasin contains only non-point sources within the watershed. As described in section 1.3. The primary uses within this subbasin are agricultural land uses.

- Medicine Lodge Creek

  Medicine Lodge Creek is on the 303(d) list for sediment, temperature and flow alteration. TMDLs are not conducted for flow alteration due to DEQ policy. Medicine Lodge Creek is listed from Spring Hollow to Small, ID, which is about 16.2 stream miles. Within the drainage of the listed section of Medicine Lodge Creek, the land is primarily used for grazing. The lower portion of the stream also supports irrigated farming.

  Most of the tributaries to Medicine Lodge Creek begin on land managed by the USFS and then flow through a mixture of BLM and private ground before reaching Medicine Lodge Creek. The main stem of Medicine Lodge Creek primarily flows through private land and small patches of BLM land. The USGS monitored water flow in two places on Medicine Lodge Creek. The hydrograph from the station located at Small, ID indicates that a major flooding event occurred in the subbasin in 1995. This high flow event caused several culverts in the subbasin to fail and induced damage to streambanks that can still be seen today.

  Depth fine material sampling at Small, ID had 32.7% fine material (<6.35 mm) and 66.5% at a mid-section of Medicine Lodge Creek, both exceeding DEQ's adapted target of <28% fine sediment. Three thermographs were placed in Medicine Lodge Creek during the 2000 season by DEQ. The USFS also placed a thermograph on Medicine Lodge Creek during the 2000 season. All four thermographs reported a major exceedance of the salmonid spawning temperature criteria of thirteen degrees C or less with a maximum daily average no greater than nine degrees C. None of the thermographs had a major criteria exceedance of the cold water aquatic life criteria.

- Edie Creek

Edie Creek is listed for nutrients, sediment and habitat alteration. TMDLs are not conducted for habitat alteration due to DEQ policy. Edie Creek is listed from the headwaters to the confluence with Medicine Lodge Creek, which is about 7.7 stream miles. The entire drainage of Edie Creek is used for grazing of livestock. A very small percentage of irrigated farming takes place along the creek in the lower portion. The headwaters of Edie Creek are on BLM land and the lower 2.5 miles of the stream flows through private property.

The road crosses Edie Creek six times on the BLM land. Depth fines were sampled from Edie Creek in 2000 by the DEQ. The percentage of fine material through core sampling at a mid-section of Edie Creek had 37.4% of fine material (<6.35mm).

The BLM also sampled nutrients on Edie Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

- Irving Creek

Irving Creek is listed for nutrients, sediment and habitat alteration. Its 303(d) boundaries are from the headwaters to the confluence with Medicine Lodge Creek (6.9 stream miles). Irving Creek's drainage area is almost entirely used for rangeland for livestock. There is a small amount of farming conducted on the private land along the stream. Irving Creek begins on USFS land and flows onto BLM land for approximately 1.1 miles and then onto private land until it converges with Medicine Lodge Creek.

Sediment samples taken on Irving Creek indicate a high amount of erosion. The stream has highly erodible banks and severe cutbanks in the upper reaches. DEQ depth fines found fine material (<6.35 mm) at 45.65%.

The BLM also sampled nutrients on Irving Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

- Fritz Creek

Fritz Creek is listed from the forks to the confluence with Medicine Lodge Creek (2.9 stream miles) and is on the 1998 303(d) list for nutrients and temperature. The entire listed segment of Fritz Creek is used for grazing. The headwaters of the north and south forks begin in forest habitat on land managed by the USFS. Below the confluence of the north and south forks of

Fritz Creek, the stream flows through private land until the confluence with Medicine Lodge Creek.

Three thermographs were placed on Fritz Creek in 2000, two by the DEQ and one by the USFS. All three thermographs had a major criteria exceedance of the salmonid spawning criteria, but did not have a major criteria exceedance for the cold water aquatic life criteria. Nutrients have not been sampled on Fritz Creek.

- Warm Springs Creek

Warm Spring Creek is on the 1998 303(d) list for nutrients and sediment. It is listed from the headwaters to the sinks, about 19.4 stream miles. The headwater of Warm Springs Creek is on BLM land, and the entire stream flows intermittently through private and BLM managed land. The drainage for Warm Springs Creek is used for rangeland.

Depth fine material sampling in 2000 reported 28.1% fine material (<6.35 mm) which is almost within the target level for fine sediment. This target, however, has been set for salmonid spawning and Warm Springs Creek is naturally thermal and devoid of salmonid fishes.

The BLM also sampled nutrients on Irving Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

3.2 Data Gaps

There is little information concerning specific contributions of non-point sources within this subbasin. A more detailed breakdown of pollutant contributions from non point sources, such as irrigated agriculture, rangelands used for grazing, diversions, and roads would be of benefit for analysis of pollutant loading. Analysis of seasonal variation of pollutant loading also may warrant further evaluation to determine if it should be a concern.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

- NRCS EQUIP Project

EQUIP is the Environmental Quality Incentives Program and was established in the 1996 Farm Bill to provide assistance for farmers and ranchers for improvement projects. The program was specifically designed for areas with serious threats to soil and water quality.

The EQUIP project in Medicine Lodge is located at Small, ID and is designed to be an educational project to display different techniques available and encourage other landowners to consider implementing EQUIP projects. This site in particular was chosen due to its visibility because it is on the main Medicine Lodge road. The site implemented various techniques such as rock barb, brush boxes, riprap, and decreasing livestock access to a water gap.

- NRCS Indian Creek Project

A state funded project took place on Indian Creek in the spring of 1999 through the Range Conservation Resource Development Program (RCRDP). The project included riparian restoration and reintroduction of beaver to the stream. The riparian restoration consisted primarily of willow planting and fencing, and there has been close to a 100% success rate for the planted vegetation.

In addition to the riparian restoration project, the RCRDP project has proposed to move 40 beaver. Eleven beaver were reintroduced into the BLM and USFS land on the east and west forks of Indian Creek in the first year. Several beaver dams have been documented in Indian Creek since the beavers were introduced.

- Conservation Reserve Program (CRP)

There are currently 5 landowners in the Medicine Lodge Subbasin who have applied for Continuous CRP. The project would include installing approximately 485 acres of riparian forest buffer with livestock exclusions. Additional applications for C-CRP are expected.

- Idaho Nonpoint Source Grant Program

In 1987 Congress enacted section 319 of the Clean Water Act to issue annual grants to States, Territories and Tribes. The money from this program is to be used to implement Watershed Restoration Actions Strategies (WRASs) to control nonpoint source pollution.

The Clark Soil Conservation District is requesting money through this program to replace seven deficient diversions located on Medicine Lodge Creek and Irving Creek. These will have a direct positive effect on water quality, fish and wildlife habitat, fish passage and the stabilization of stream channels. The diversions will be the first step in the implementation plan of the Soil Conservation Commission. Subsequent implementation efforts will include prescribed grazing, streambank stabilization, buffers and stream channel stabilization. The draft implementation plan for the Medicine Lodge subbasin is presented in Appendix F.

- Teton Regional Land Trust

The Teton Regional Land Trust Inc. (TRTL) is a non-profit, community organization with the mission to conserve agricultural and natural lands and encourage land stewardship in the Upper Snake River Valley. They serve six Idaho counties: Bonneville, Clark, Fremont, Jefferson, Madison and Teton; and Teton County, Wyoming, west of the Tetons.

TRTL is a small grassroots organization that was started by a number of concerned citizens who wanted to protect the agricultural and natural values of this region. TRTL members are farmers, ranchers, and residents interested in protecting the land, rivers and communities for generations to come. TRTL identifies the tools and resources for landowners to better manage their lands and find ways to help families retain their farms and ranches that are threatened by development.

TRLT has worked with private landowners in the Medicine Lodge Subbasin to put 2,617 acres of private land into conservation easements. This land encompasses different areas throughout the drainage, and legally limits the amount of development that can take place on the land.

- Caribou-Targee National Forest

The Caribou-Targee National Forest has completed a project to reduce streambank erosion within the Medicine Lodge Subbasin. The main actions include installing several enclosures along Fitz Creek.

5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation (WLA); and nonpoint sources, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (40 CFR § 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For

certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Instream Water Quality Targets

The goal of this TMDL is to restore "full support of designated beneficial uses" on all 303(d) listed streams within the Medicine Lodge subbasin. Water quality pollutants of concern, for which a TMDL has been being developed, are sediment and temperature. The objective for this TMDL will be to establish a declining trend in sediment loading, and to regularly monitor the sediment load and to decrease water temperatures throughout the subbasin by increasing canopy coverage and decreasing width/depth ratios along streambanks for attainment of beneficial use support. The sediment target for this TMDL will be the percentage of subsurface fines less than 6.35 mm (0.25 in) sediment and 80 % stable streambanks. This will be done by measuring the percentage of subsurface fines and conducting stream bank erosion inventories. A sediment TMDL has been developed for Medicine Lodge Creek, Irving Creek, and Edie Creek.

The temperature TMDL target is the numeric salmonid spawning criteria listed in the state water quality standards [IDAPA 58.01.02.250.02.b]. Instream targets shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods. Based on thermograph data presented in the subbasin assessment, all streams in which thermal data has been collected within the Medicine Lodge subbasin exceed temperature criteria for salmonid spawning, therefore, all streams will have a temperature TMDL, with the exception of the lower portion of Blue Creek, Medicine Lodge Creek, Warm Springs Creek, Divide Creek, and Deep Creek due to reasons described in Sections 2.3 and 2.4 of the Subbasin Assessment.

Design Conditions

- Seasonal Variation and Critical Time Periods of Sediment Loading

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. This sediment analysis characterizes sediment loads using average annual rates determined from empirical characteristics that developed over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame, however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

Annual erosion and sediment delivery are greatly a function of climate where wet water years typically produce the highest sediment loads. Additionally, annual average sediment load is not distributed equally throughout the year. Erosion typically occurs during a few critical months. For example, in the Medicine

Lodge watershed, most streambank erosion occurs during spring runoff while most hillslope erosion occurs during summer thunderstorms and spring runoff.

This sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event

Temperature Critical Time Periods

- The critical time periods for salmonid spawning when salmonid spawning temperature criteria should be met within the Medicine Lodge Subbasin are identified as occurring during May 1 through July 15, for rainbow trout and Yellowstone cutthroat trout; and October 1 through November 15, for brook trout. The salmonid spawning critical time periods for species within this subbasin are default periods from the Water Body Assessment Guidance, second edition (WBAG). According to the WBAG manual, brook trout salmonid spawning periods are from October 1 through June 1, however, for this TMDL, salmonid spawning criteria was not considered past November 15 since it is likely that temperature exceedances will not occur after November 15 and temperature data was not collected beyond this date.

Target Selection

- Target selection of sediment is dependent on existing narrative criteria of [IDAPA 58.01.02.200.08].

- Sediment Targets for this subbasin are based on streambank erosion quantitative allocations in tons per year. Reduction in stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density and structure to armor streambanks, reduce lateral recession, trap sediment and reduce the erosive energy of the stream thus reducing instream sediment loading. It is assumed that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Therefore, the established instream water quality target of 28%or less fine sediment <6.35mm in areas suitable for salmonid spawning. If sites meet this criterion, beneficial uses for salmonid spawning are likely full support.

- Other parameters for subsurface fines can affect salmonid production. Chapman (1988) suggested that fine sediment <0.85 mm (0.03 in) in diameter is most responsible for suffocation and abrasion of salmonid eggs. Tappel and Bjornn (1983) report that sediment <9.5mm (0.37 in) in diameter can create a survival barrier preventing salmonid fry emergence from the redd. Hall

(1986) found survival (eyed-egg to emergence) of coho, chinook and chum salmon to be only 7-10% in gravel mixtures made up of 10% fines as compared to 50-75% survival in gravel mixtures with no fines <0.85 mm (0.03 in). Reiser and White (1988) observed little survival of steelhead and chinook salmon eggs beyond 10-20% fines <0.85 mm (0.03 in). These sediment particle size parameters should be considered as part of target < 0.85 mm (0.03 in). These sediment particle size parameters should be considered as part of target monitoring to evaluate any significant shift in subsurface fine particle frequency distribution.

- In addition to sediment substrate sampling, streambank erosion inventories will be conducted on Medicine Lodge Creek, Irving Creek, and Edie Creek. It is assumed that that natural background sediment loading rates equate to 80% bank stability as described in Overton and others (1995), where banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally 80% or greater for Rosgen A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types. Therefore, an 80% bank stability target based on streambank erosion inventories shall be the target for sediment.

- Temperature TMDL criteria is based on existing numeric criteria of [IDAPA 58.01.02.250(02)(e)(ii)] for salmonid spawning. Instream targets shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods.

Monitoring Points

- Subsurface Sediment Monitoring

Subsuface sediment substrate monitoring points shall occur in habitat determined suitable for salmonid spawning within listed stream segments using the McNiel core sediment sampling method. The amount of habitat suitable for salmonid spawning will increase after implementation of management practices identified to reduce subsurface fine sediment.

- Streambank Stability Monitoring

Streambank erosion inventories shall occur along the entire reaches of Medicine Lodge Creek, Irving Creek, and Edie Creek.

- Temperature Monitoring

Temperature monitoring points shall be collected at existing temperature logger data collection sites to maintain consistency with past monitoring events. Site locations for temperature loggers are described in Appendix E.

5.2 Load Capacity

The load capacity of a stream or waterbody is "the greatest amount of loading a water can receive without violating water quality standards" [40 CFR §130.2]. This must be a level to meet "...water quality standards with season variations and a margin of safety which takes into account any lack of knowledge..." (CWA § 303(d)(C)). Likely sources of uncertainty include lack of knowledge of assimilative capacity, uncertain relation of selected target(s) to beneficial use(s), and variability in target measurement.

- Sediment loading capacities for Medicine Lodge Creek, Irving Creek, and Edie Creek, are quantitatively estimated in tons per year as shown in Table 23. These numbers are based on streambank erosion inventories conducted by the Soil Conservation Commission and Natural Resources Conservation Service in 2000.

Table. 23 Sediment Load Capacity

Steam Name	**Proposed Total Erosion (t/y)**	**Proposed Erosion Rate (t/mi/y)**
Edie Creek	95.4	36.7
Irving Creek	376.2	89.6
Medicine Lodge Creek	1210.2	46

- Sediment target levels are based on natural streambank erosion inventories. Since it is assumed that natural stream bank erosion targets of 80% or greater and the substrate sediment target of 28% or less fine sediment substrate <6.35 mm will support beneficial uses, these are also used in calculating loading capacities for Medicine Lodge Creek, Edie Creek, and Irving Creek.

- The natural background loading rates are not necessarily the loading capacities. An adaptive management approach will be used to provide reductions in sediment loadings based on BMP usage coupled with data collection and monitoring to determine the loading point at which beneficial uses are at full support.

- The estimated capacity is directly related to the improvement of riparian vegetation density and structure as well as maintenance of stream crossings. Increased vegetative cover provides a protective covering of streambanks, reduces lateral recession, traps sediment and reduces erosive energy of the stream..

- The temperature load capacity for the purpose of this TMDL is determined by state water quality standards for temperature based on numeric water quality criteria for salmonid spawning and cold water aquatic life.

- The temperature loading capacity for salmonid spawning shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods. Salmonid spawning periods for the Medicine Lodge subbasin are May 1 through June 30 for Rainbow Trout and Cutthroat Trout and, October 1 through November 15 for Brook Trout.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (40 CFR 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

- Method(s) of Estimation of Allocation
  The method of estimation of allocation used is based on the principal TMDL equation:

  TMDL = Load Capacity = Waste Load Allocation + Load Allocation + Margin of Safety

- The load capacity is an estimate of loading a water body can handle and can still meet water quality standards, as previously defined in Section 5.2.

- Waste Load Allocation (WLA) is the amount of loading contributing to a water body from point sources within the watershed. There are no point sources within the Medicine Lodge subbasin therefore, WLA is equal to zero.

- Load Allocation (LA) is the amount of loading contributing to a water body from non point sources within the watershed. All contributing loads to the Medicine Lodge watershed result from nonpoint sources within the watershed. Land uses within the Medicine Lodge are primarily agriculture related, therefore agriculture is the primary contributing source of loading. Other contributing non-point sources include roads, diversions, and recreational activities.

- Margin of Safety (MOS) accounts for uncertainty in available data in which load allocations are derived. In this case, the margin of safely is implicit for both sediment and temperature loading. The MOS is described in Section 5.4.

- Seasonal variation for sediment loading and temperature loading were considered for this TMDL. Sediment loading of streams is episodic in nature. It is not possible to monitor a stream each time bank erosion or sloughing

occurs. Sediment streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated, typically during the spring and early summer months. The accumulative load from bank mass wasting is accounted for in sediment inventory monitoring, thus erosion inventory monitoring takes into account seasonal variation of streambank erosion. Seasonal variation in the temperature TMDLs are accounted for by evaluating temperatures exceedances during critical spring and fall salmonid spawning periods and temperature exceedances observed during the summer months, when temperatures are the highest. Further collection of data during implementation of this TMDL may warrant adjustments for seasonal variation to the current TMDL.

- Current sediment loading for Medicine Lodge Creek, Irving Creek, and Edie Creek, are quantitatively estimated in tons per year as shown in Table 24. These numbers are based on streambank erosion inventories conducted by the Soil Conservation Commission and Natural Resource Conservation Service in 2000.

Table. 24 Estimated Current Load for Sediment in the Medicine Lodge Subbasin

Steam	Existing Total Erosion (t/y)	Existing Erosion Rate (t/mi/y)
Edie Creek	484.5	186.3
Irving Creek	2026.2	482.4
Medicine Lodge Creek	3368.1	128.1

- Current temperature loading for streams exceeding salmonid spawning criteria within the Medicine Lodge subbasin is listed in Table 25. Temperature readings using temperature data loggers occurred for June 16 through October 16, 2000. Exceedances are triggered during salmonid spawning periods which are May 1 through July 1 and October 1through November 15. Data collected indicated all streams within the Medicine Lodge subbasin exceeded salmonid spawning criteria at least 10% of the time, and thus, a violation in these standards (IDEQ, 2000).

- A Temperature TMDL for the lower reach of Medicine Lodge Creek will not be done since this section is considered rearing but not spawning habitat for salmonids, as described in Section 2.3 on the subbasin assessment.

Table. 25 Estimated Current Load for Temperature in the Medicine Lodge Subbasin

Stream Name	Maximum Number of Days Exceedances[a]	Highest Instantaneous Value (ºC)	Highest Average Daily Value (ºC)
Crooked Creek	30	19.00	12.02
Deep Creek	39	25.3	18.4
East Fork Irving Creek	18	13.39	9.68
Edie Creek (at BLM Boundary)	30	17.79	12.84
Edie Creek (at mouth)	30	16.78	13.55
Fritz Creek (at mouth)	30	20.65	14.23
Fritz Creek (below forks)	29	18.02	13.73
Horse Creek	38	18.13	14.96
Indian Creek	30	18.60	13.46
Irving Creek (at mouth)	30	19.13	13.99
Medicine Lodge Creek (above Middle Creek)	30	19.01	16.48
Medicine Lodge Creek (at Small, ID)	30	19.55	17.47
Medicine Lodge Creek (at Spring Hollow)	30	20.21	15.86
Middle Creek (mouth)	30	18.91	15.70
Warm Creek	30	20.84	17.80
Webber Creek (at mouth)	31	18.60	13.80
Webber Creek (at trailhead)	24	15.58	11.26

[a] Exceedances are considered any day exceeding 13º C instantaneous value or 9º C average daily value or 22 ºC (71.6 º F) and the maximum daily average temperature below 19 ºC (66.2 ºF) for streams exceeding CWAL criteria.

5.4 Load Allocation

The load allocation is the amount of loading capacity allocated to a given water body source without exceeding water quality criteria. For the Medicine Lodge subbasin, load allocations have been developed for sediment and temperature. As

described in section 5.3, the TMDL is equal to the sum of all load allocations which is equal to the load capacity of the stream. Table 26, 27, and 28 provide the load capacities for each stream and the total reduction from the current loading rates to meet load capacities within the streams. Temperature load capacities are the state water quality numeric criteria.

Table 26. Existing and Proposed Sediment Erosion and Associated Reductions.

	Estimated Load		Load Capacity / Load Allocation		Reduction Needed		
Stream	**Existing Total Erosion (t/y)**	**Existing Erosion Rate (t/mi/y)**	**Proposed Total Erosion (t/y)**	**Proposed Erosion Rate (t/mi/y)**	**Total Erosion Reduction (t/y)**	**Total Erosion Reduction Rate (t/mi/y)**	**Percent Reduction Needed to meet Load capacity**
Edie Creek	484.5	186.3	95.4	36.7	389.1	149.6	80.3%
Irving Creek	2026.2	482.4	376.2	89.6	1650.2	392.8	81.4%
Medicine Lodge Creek	3368.1	128.1	1210.2	46.0	2157.9	82.1	64.1%

?? The TMDL for Edie Creek, Irving Creek, and Medicine Lodge Creek are 95.4, 376.2, and 1210.2 tons/year, respectively. Percent reduction of the existing sediment load for Edie Creek, Irving Creek, and Medicine Lodge Creek are 80.3%, 81.4%, and 64.1% respectively.

Table 27. Existing and Proposed Temperature Loads and Reductions for Salmonid Spawning.

		Estimated Load		Reduction Needed	
Stream Name	**Maximum number of days exceedances ***	**Highest Instantaneous Value (ºC)**	**Highest average daily value (ºC)**	**% Reduction needed to attain 13ºC instantaneous value**	**% Reduction to attain 9ºC average daily value**
Crooked Creek	30	19.00	12.02	31.6%	25.1%
Deep Creek	39	25.3	18.4	48.6%	51.1%
East Fork Irving Creek	18	13.39	9.68	2.9%	7.0%
Edie Creek (at BLM Boundary)	30	17.79	12.84	26.9%	29.9%
Edie Creek (at mouth)	30	16.78	13.55	22.5%	33.6%
Fritz Creek (at mouth)	30	20.65	14.23	37.0%	36.8%
Fritz Creek (below forks)	29	18.02	13.73	27.9%	34.5%

Stream Name	Maximum number of days exceedances *	Estimated Load: Highest Instantaneous Value (ºC)	Estimated Load: Highest average daily value (ºC)	Reduction Needed: % Reduction needed to attain 13ºC instantaneous value	Reduction Needed: % Reduction to attain 9ºC average daily value
Horse Creek	38	18.13	14.96	28.3%	39.8%
Indian Creek	30	18.60	13.46	30.1%	33.1%
Irving Creek (at mouth)	30	19.13	13.99	32.0%	35.7%
Medicine Lodge Creek (above Middle Creek)	30	19.01	16.48	31.6%	45.4%
Medicine Lodge Creek (at Spring Hollow)	30	20.21	15.86	35.7%	43.3%
Middle Creek (at mouth)	30	18.91	15.70	31.3%	42.7%
Warm Creek	30	20.84	17.80	37.6%	49.4%
Webber Creek (at mouth)	31	18.60	13.80	30.1%	34.8%
Webber Creek (at trailhead)	24	15.58	11.26	16.6%	20.1%

*exceedances are considered any day exceeding 13ºC instantaneous value or 9ºC average daily value

- The percent reduction in temperature are based on the highest recorded temperatures during the June 16 through October 16 monitoring period during the salmonid spawning critical time periods. Percent temperature reductions range from 2.9% reduction on East Fork Irving Creek to 51.1% on Deep Creek. The highest percent reduction values shown for each stream segment is the TMDL.

Load Allocations by Land Ownership

- Load allocations by land ownership will not be done for this TMDL. The sediment load reductions are based solely on streambank erosion inventories therefore, the contributing source is linked solely to stream bank erosion. During Implementation of this TMDL, management practices to reduce streambank erosion will be employed. An adaptive management approach will be used to provide reductions in sediment loadings based on BMP usage coupled with data collection and monitoring to determine the loading point at which beneficial uses are at full support. The effectiveness of these activities will be monitored every other year through sediment substrate sampling and streamank erosion inventories.

- It is assumed that, as riparian conditions improve over the listed reaches in the Medicine Lodge Subbasin as part of implementation activities, the added benefit of reduced thermal loading will likely be realized and the temperature regime in these streams will likely improve.

- Management practices for streams that are not listed but exceed temperature criteria based on temperature data collected and summarized within this subbasin assessment and TMDL will be to increase streambank cover and decrease width/depth ratios, and implement water conservation practices will decrease thermal loading.

Seasonal Variation

- Seasonal variability was integrated in the development of this TMDL. The largest amount of sediment loading typically occurs during the spring and early summer run-off events with sporadic summer thunderstorm events also contributing. Stream erosion inventory monitoring accounts for the fact that most bank recession during peak flow events, which accounts for seasonal loading. By measuring how much the bank has receded each year, sediment erosion inventory monitoring records sediment loading events that typically occur episodically during the spring and early summer run-off events.

- Seasonal variability was incorporated into temperature TMDLs by taking into account the critical seasons for critical life stages of fish species present. Stream temperatures were evaluated during the hottest time of the year (summer), and during critical salmonid spawning time periods. The TMDL reductions are set during this period where there is the greatest exceedances and there is greatest variation between current in-stream temperature and the temperature criteria.

Margin of Safety

- The margin of safety (MOS) is factored into load allocations for sediment for Edie Creek, Irving Creek, and Medicine Lodge Creek. The MOS is the conservative assumptions used to develop existing sediment loads, where background conditions are more than needed to attain full support of uses are employed. Conservative assumptions made as part of the sediment loading analysis include: 1) Desired bank erosion rates are representative of background conditions of 80 %, as described in Overton and others ; 2) Water quality targets for percent depth fines of less than 28% (<6.35mm), are consistent with values measured and set by local land management agencies based on established literature values and incorporate a more than adequate level of fry survival to provide for stable salmonid production. It is assumed that the status of beneficial uses will be improved prior to the attainment of the targets of 80 % erosion rates and less than 28% depth fines in this TMDL.

- The MOS factored into load allocations for water temperature is based on the maximum observed temperature exceedances for each critical time period. Maximum exceedances of the most restrictive criteria were used to identify needed temperature reductions based upon the assumption that if temperature reductions are directed at eliminating the recorded maximum exceedance of criteria, then lesser exceedances will be eliminated during other times of the year.

Background

- It is assumed the beneficial uses were or would be more than supported at natural background sediment loading rates. Natural background loading rates are assumed to be natural the sediment loading capacity, based on an 80% or greater bank stability and 28% or less sediment substrate fines. Therefore natural background is accounted for in the load capacity. If it is established that full support of beneficial uses is achieved at intermediate sediment loads above natural background levels, and that narrative sediment standards are being met, the TMDL will be revised accordingly.

Reserve

- Since the loading capacity is assumed to be the natural background loading capacity, beneficial uses may be supported at high rates of sediment loading. If it is established that full support of beneficial uses is achieved at intermediate sediment loads and that narrative sediment standards are being met, the TMDL will be revised accordingly to allow for future growth.

5.5 Conclusions

The primary water quality concerns within the Medicine Lodge Subbasin are related to subsurface fine sediment deposited within the stream substrate and thermal loading during salmonid spawning periods, which is likely impacting the abundance and quality of fish habitat. The primary source of sediment and increased water temperatures appears to be streambank erosion. The primary cause of streambank erosion and increased temperatures is related to the downcutting of the stream channel and the subsequent sloughing of streambanks. Many areas of the Medicine Lodge watershed are re-establishing a flood plain. This process will likely take many years and will result in much additional streambank erosion. Riparian vegetation will likely re-establish on outside bends in which it is absent as the re-stabilization process takes place. Additionally, as riparian conditions improve over the listed reaches in the Medicine Lodge Subbasin, the added benefit of reduced thermal loading will likely be realized and the temperature regime in these streams will likely improve. For newly listed reaches for temperature, implementation will include increasing streambank cover, decrease width/depth ratios, and implementing water conservation practices similarly done on sediment listed streams. In addition, salmonid

spawning temperature criterias set in this TMDL shall be further evaluated during implementation of this TMDL to ensure the standards set are reflective of spawning time periods in the Medicine Lodge Subbasin.

The development of an implementation plan for Medicine Lodge Creek Subbasin is currently underway and the draft plan is found in Appendix F. The implementation plan identifies Best Management Practices (BMPs) that will be implemented throughout the subbasin to improve riparian condition and stream channel habitat and reduce streambank erosion. BMPs that will be implemented within the subbasin focus on agricultural irrigation diversions, irrigation efficiency, and prescribed livestock grazing protection.

- It is anticipated that the amount of habitat suitable for salmonid spawning will increase after implementation of management practices identified to reduce subsurface fine sediment and steam temperatures. Subsurface fine sediment and salmonid age class structure and stream temperatures will be monitored every other year beginning at completion of the initial implementation phase. By the completion of the third monitoring period, if the percentage of subsurface fine sediment is not decreasing, additional management practices will be applied to attain the target

- It is anticipated that by reducing the chronic sediment load through increased streambank stability, the instream target of 28% subsurface fines and temperature supporting beneficial uses will be achieved. The beneficial use of natural spawning by salmonids should eventually be restored to full support prior to attaining the instream target set in this TMDL. Streambank stability, the percentage of subsurface fines in salmonid spawning habitat and age class structure of salmonids must be monitored every other year to determine the effectiveness of land management activities and of this TMDL.